

**GREENHOUSE GAS EMISSIONS MANAGEMENT PROGRAM**  
**CITY OF FLAGSTAFF ■ ARIZONA**

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**Executive Summary  
For  
Community Public Comment**

**Prepared by  
The City of Flagstaff Sustainability Program**

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Global climate change caused by increasing concentrations of atmospheric carbon dioxide and other greenhouse gases (GHGs) is one of the most significant threats facing our world today. Over the course of this century the planet may experience the effects of global climate change, including increased temperatures, rising sea levels, higher risks of severe floods and storms, and a depletion of crucial natural resources. Climate change is a global problem, but its effects will be very local. While there are some steps that can be taken to adapt to warmer temperatures, the greatest urgency is to prevent further climate change by reducing GHG emissions. This will need to be a global effort, but each community can play a significant role.

In September 2006, the City of Flagstaff Mayor Joe Donaldson signed the U.S. Mayors Climate Protection Agreement, a voluntary pledge to reduce GHG emissions. The Agreement was later endorsed by the U.S. Conference of Mayors. Under the U.S. Conference of Mayors Climate Protection Agreement, participating cities commit to:

1. Strive to meet or beat the Kyoto Protocol targets in their own communities (i.e. reduction of GHGs by 7 percent from 1990 levels by 2012);
2. Urge the state and federal government to enact policies and programs to meet or beat the Kyoto Protocol targets; and
3. Urge the U.S. Congress to pass the bipartisan GHG reduction legislation.

As part of this agreement, the City of Flagstaff joined the network of more than 750 municipalities worldwide actively involved in the International Council for Local Environmental Initiatives' (ICLEI) Cities for Climate Protection® (CCP) Campaign. Expanding on this commitment, the Sustainability Program was created and charged with developing a comprehensive sustainability plan for the City of Flagstaff's future. This effort will put forward a strategy to reduce the City of Flagstaff's GHG footprint, while also accommodating population growth, and improving the infrastructure and environment. Recognizing the importance of doing its part to reduce global carbon emissions, the City of Flagstaff has set the goal of reducing its GHG emissions by 7 percent below 1990 levels by 2012, in accordance with the Kyoto Protocol.

The GHG emissions inventory, forecasts, and reduction targets included in this report complete the first and second phases in the CCP Campaign, beginning a process that will continue with the implementation of the City of Flagstaff's climate management plan. Assessing a city's GHG emissions allows for the identification of the major sources of emissions, demonstrates any trends that exist, and shows the impact of actions taken to date. This inventory quantifies GHG emissions that are produced by the Flagstaff Community and as a result of the City of Flagstaff Municipal Operations in the sectors of building energy use, vehicle fuel consumption, solid waste generation and management, streetlight and traffic signal energy use, transit operations, and water and sewer facility energy use.

Unless otherwise noted, the Flagstaff Community inventory base year for data collection is 1990, as this is the year against which the target is measured. Additional data were also collected and analyzed for the years 2004 and 2005 to assess the City of Flagstaff's current level of GHG emissions, and also to forecast future year inventories. Information

about ongoing government projects that contribute to reducing GHG emissions was also gathered to allow the City of Flagstaff to assess its progress and to help guide new policy decisions. Data are reported in units of metric tons of carbon dioxide equivalent (CO<sub>2</sub>e), a common unit that allows emissions of GHG of different heat trapping potential to be added together and allows a direct comparison of different GHGs. The inventory detailed in this report is for the year 2005, as these are the most current data, and are the basis for which the GHG mitigation strategies were developed.

## **1.1 2005 INVENTORY RESULTS**

In 2005, the City of Flagstaff's total GHG emissions were approximately 1.6 million metric tons of CO<sub>2</sub>e.<sup>1</sup> Of these, 47 percent were attributable to the transportation sector. From 1990 to 2005, CO<sub>2</sub>e emissions increased by a total of 41 percent. To fulfill the Kyoto Protocol goal, the City of Flagstaff's emissions target would be approximately 1.1 million metric tons of CO<sub>2</sub> equivalents, which is approximately 560,000 tons less than current (2005) levels. This corresponds to a reduction of over 34 percent from current (2005) levels.

A preliminary inventory and forecast of GHG emissions for the City of Flagstaff for years 1990 through 2020 was produced, focusing on the years 1990, 2004, 2005, 2012, and 2020. The inventory provided several critical findings, including the following:

- Between 1990 and 2005, the City of Flagstaff's net GHG emissions increased by over 41 percent, from an estimated 1.1 million metric tons CO<sub>2</sub>e to an estimated 1.6 million metric tons CO<sub>2</sub>e.
- The City of Flagstaff's GHG emissions are forecasted to increase by 60 percent from 1990 to 2020, taking into account the effects of recent energy efficiency actions adopted by the City.
- The transportation sector accounts for nearly half of the City of Flagstaff's total GHG emissions.

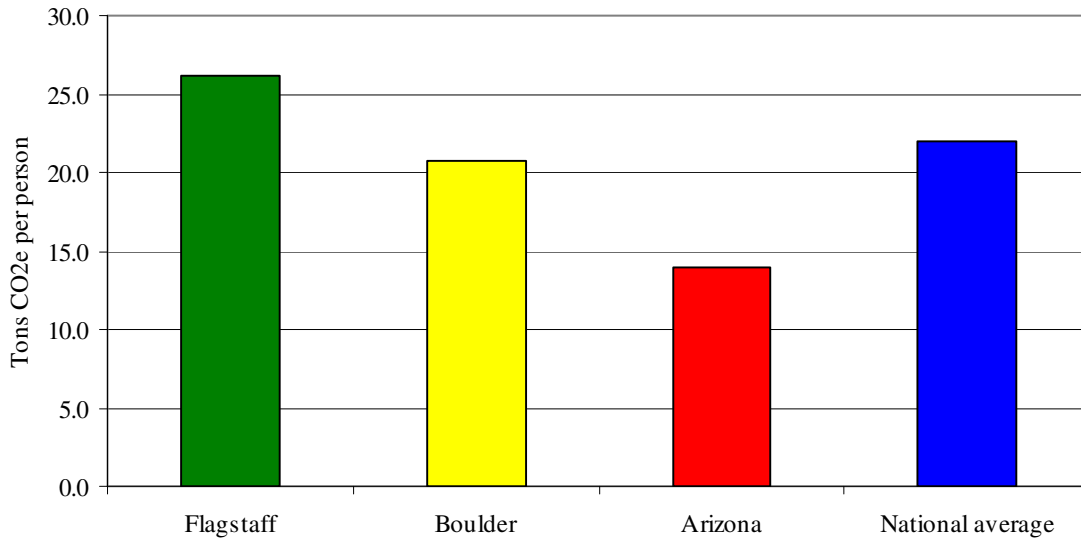
In 2005, the average per capita GHG emissions in the City of Flagstaff was 26.2 tons CO<sub>2</sub>e per person per year. This is above the national average of 22 tons of CO<sub>2</sub>e, and well above the average for the State of Arizona, which was 14 tons of CO<sub>2</sub>e per person. However, due to its location, the residents of Flagstaff consume much more energy than the majority of Arizonans during the winter months for heating purposes. A comparison of the per capita GHG emissions is shown in Figure 1-1. The City of Boulder, Colorado provides a comparison to a community of similar size, climate, and geographic location. The per capita GHG emissions in Boulder are lower than those of Flagstaff. This is due primarily to the transportation through the City of Flagstaff, which, as shown in Section 4, contributes nearly half of the City of Flagstaff's GHG emissions. The City of Flagstaff serves as a hub to tourists visiting the Grand Canyon, and also lies at the intersection of two main trucking routes. These two factors do not affect cities such as Boulder, and therefore the impact of transportation is much less in these cities. In fact, the transportation sector GHG emissions from the City of Boulder are less than those of

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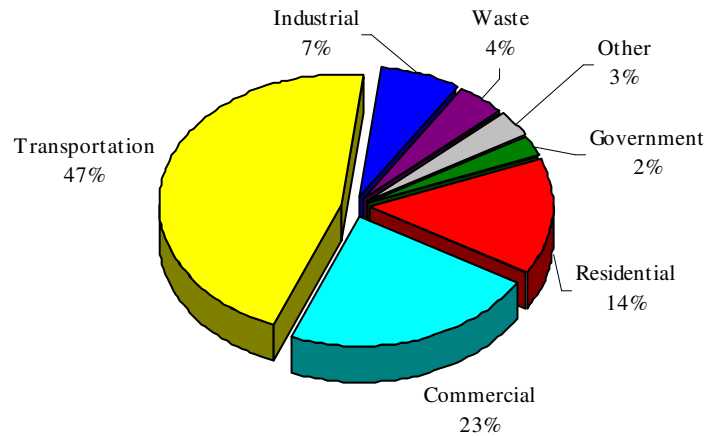
<sup>1</sup> All emissions of CO<sub>2</sub>e in this report are reported in units of metric tons (one metric ton equals 1,102 short tons).

Flagstaff, even though Boulder has almost double the population of Flagstaff.<sup>2</sup> Figure 1-2 shows the distribution of total Flagstaff Community CO<sub>2</sub>e emissions by sector in 2005.

**FIGURE 1-1 COMPARISON OF PER CAPITA GREENHOUSE GAS EMISSIONS**



**FIGURE 1-2 CITY OF FLAGSTAFF 2005 GHG EMISSIONS BY SECTOR**



## 1.2 EMISSION REDUCTION STRATEGIES

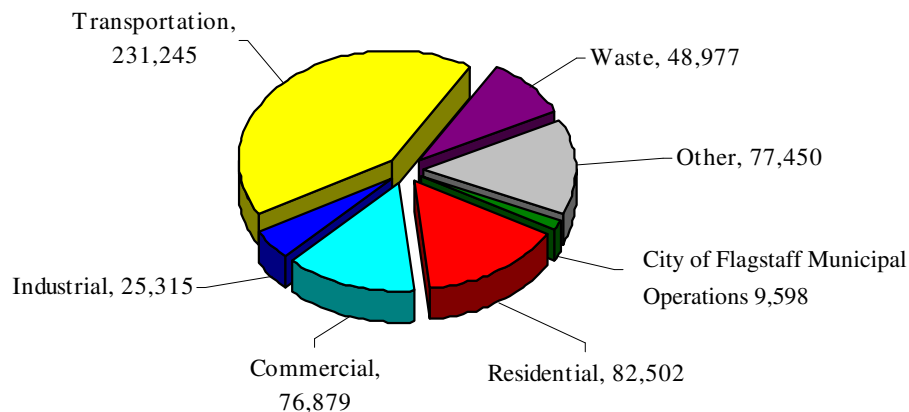
This report provides several recommendations on mitigation strategies which could be utilized by the City of Flagstaff to achieve the goal of a 7 percent reduction below 1990 emissions levels by the year 2012, which is aggressive compared to GHG reduction goals established by other cities and states. It is to be noted that other cities and localities around the country, which have developed GHG management programs, are struggling to meet this aggressive target. Early action and implementation of GHG emission reduction policies are critical to put the City of Flagstaff quickly on the path toward significant

<sup>2</sup> Data for the City of Boulder found in: "Boulder County, Colorado Greenhouse Gas Inventory Final Report", December 27, 2006.

GHG emissions reductions. In fact, the city government has already begun implementing some policy options to reduce GHG emissions, including energy conservation measures (ECMs), a cogeneration project, and green energy purchases, among others. These measures would result in a total annual avoidance of 8,392 metric tons of CO<sub>2</sub>e emissions in 2012, and reduce the 2012 Municipal Operations emissions to 3 percent below the 1990 levels. Without the implementation of these reduction measures, the projected 2012 GHG emissions from Municipal Operations would be 18 percent higher than the 1990 levels. More than 60 additional reduction measures are recommended in this report.

As illustrated in Figure 1-3, the majority of the proposed reductions are associated with energy efficiency and renewable energy policy options in the transportation sector. However, it can also be seen that significant emission reductions can be achieved in every sector. The proposed emission reduction strategies by sector are outlined in detail under Section 6.

**FIGURE 1-3 GHG EMISSION REDUCTIONS BY SECTOR (IN TONS CO<sub>2</sub>E)**



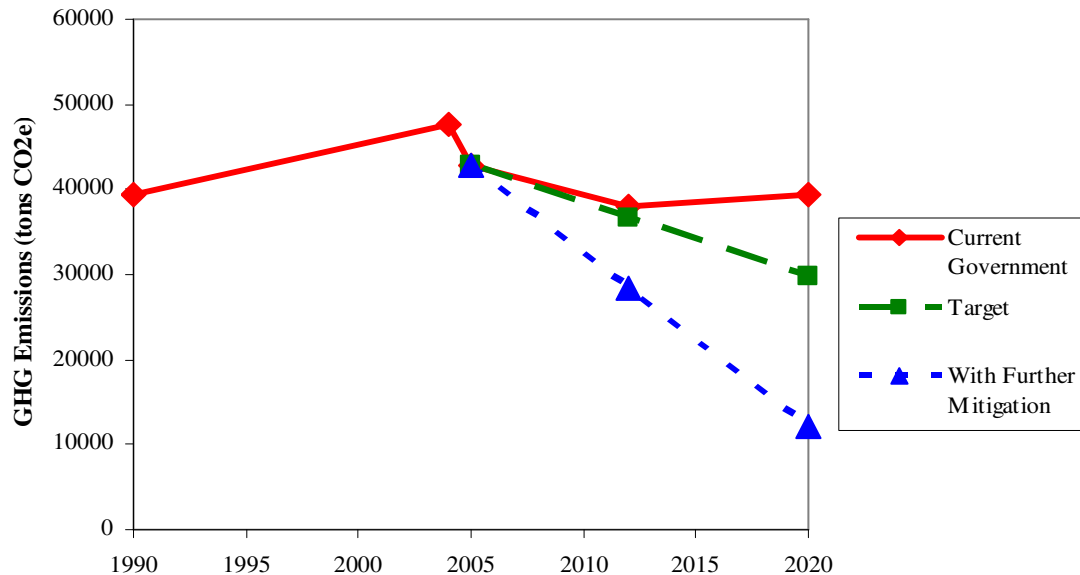
Of the 60 total proposed GHG reduction measures, 32 are proposed for the reduction of GHG emissions from Municipal Operations. Based on the compiled emission inventory, electricity consumption by water/sewage systems and municipal buildings is the major source of municipal GHG emissions, contributing approximately 80 percent of municipal GHG emissions. Fuel consumption by municipal vehicle fleet and employee commute is the second major source of municipal GHG emissions and contributes almost 20 percent of the municipal GHG emissions. Therefore, the implementation of GHG reduction measures for electricity consumption by the water/sewage systems and municipal buildings is of primary importance to reduce the municipal GHG emissions. The most useful and significant reduction measures are listed as follows:

- Install energy efficient technology in water/sewage systems
- Install energy efficient equipment and lighting in municipal buildings
- Purchase green electricity for water/sewage systems and municipal buildings
- Install Variable Frequency Drive (VFD) well pumps

With these additional proposed measures, an additional annual reduction of 9,423 metric tons of CO<sub>2</sub>e could be achieved by 2012. This will further reduce 2012 municipal

emission levels to 27 percent below their 1990 levels. Figure 1-4 shows the historic and future predicted emissions for the Municipal Operations for both the scenarios of business as usual (including the already implemented emission reduction strategies), and further implementation of every municipal mitigation strategy outlined here.

**FIGURE 1-4 HISTORIC AND FUTURE GHG EMISSIONS FOR THE CITY OF FLAGSTAFF MUNICIPAL OPERATIONS**



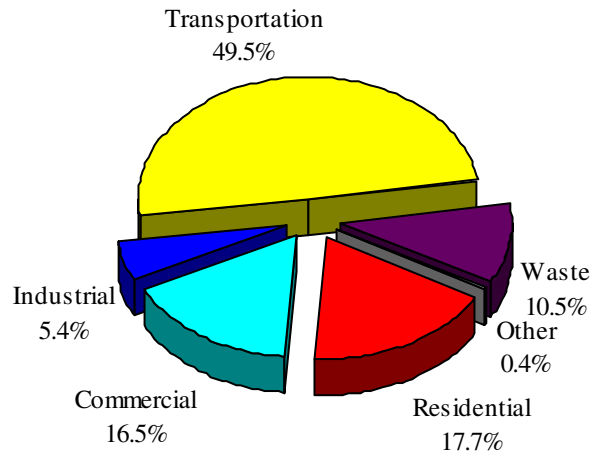
### 1.3 RECOMMENDED COMMUNITY MITIGATION MEASURES

The City of Flagstaff community contributes more than 96 percent of total GHG emissions. Among the community sectors, transportation is the highest emission sector, contributing to approximately 50 percent of total community GHG emissions. Electricity and natural gas consumption by residential and commercial sectors contributes approximately 40 percent of total GHG emissions, and is the second major source of community emissions. Therefore, it is recommended that the City of Flagstaff focus on reducing GHG emissions from transportation and residential/community energy usage. The following lists the most significant reduction measures:

- Implement the federal Renewable Fuels Standard (RFS)
- Increase the number of hybrid cars
- Implement codes for energy efficient residential and commercial buildings
- Facilitate green power purchases in the residential and commercial sectors
- Implement the federal Corporate Average Fuel Economy (CAFE) Standard
- Facilitate a Community Trip Reduction Program

The following section provides a discussion of GHG emission reduction measures for the Flagstaff Community and the projected impact from each measure. These measures are projected to result in the annual GHG reductions of 466,758 metric tons of CO<sub>2</sub>e by 2012. Figure 1-5 illustrates the GHG reduction contribution from each community sector.

**FIGURE 1-5 PROPOSED FLAGSTAFF COMMUNITY GHG REDUCTION MEASURES  
(466,758 METRIC TONS OF CO<sub>2</sub>E)**



With the proposed Flagstaff Community GHG reduction measures, a total reduction of 466,758 metric tons of CO<sub>2</sub>e may be achieved by 2012, which brings the 2012 Flagstaff Community emission levels to **10 percent above** 1990 community levels. Without any reduction, the Flagstaff Community 2012 emission levels are projected to increase to 1,695,492 metric tons of CO<sub>2</sub>e, which is **52 percent above** 1990 levels.

Descriptions of possible GHG emission reduction strategies are outlined below for each sector.

### **Residential**

GHG emission from the residential sector accounts for 15 percent of the total Flagstaff Community GHG emissions, primarily through the use of electricity and combustion of natural gas. Based on this emission profile, the following GHG reduction measures are recommended:

- Energy efficient building construction (CR-1)
  - In 2006, the International Energy Conservation Code (IECC) was established. The City of Flagstaff requires the commercial and residential sectors to comply with this energy code and submit compliance forms. Many requirements in the energy conservation code will reduce energy consumption and reduce GHG emissions. The ENERGY STAR program evaluates products and buildings for energy efficiency. It is recommended that an education outreach program be developed in the City of Flagstaff to encourage residents and businesses to install ENERGY STAR appliances and equipment. The following list summarizes the actions that can be taken to promote the ENERGY STAR program and compliance with IECC:
    - Develop and adopt building codes that set energy efficiency standards for construction;
    - Require energy efficient retrofits at the time of sale for all residential properties;
    - Offer financial incentives to builders who construct energy efficient homes and buildings;

- Require improvements in energy efficiency during remodeling/redevelopment projects;
- Encourage passive solar design and solar orientation incentives, guidelines, and ordinances;
- Encourage the use of energy efficient appliances and HVAC systems;
- Promote building insulation and weatherization.
- Incorporate building efficiency into the construction permit inspection process;

If 20 percent of natural gas and 10 percent of electricity can be offset through the energy efficient building program, a total of 36,219 metric tons of CO<sub>2</sub>e emissions can be prevented.<sup>3</sup>

- Energy efficient equipment and lighting (CR-2)
  - National regulations: Energy Efficient Appliance Standard  
The Energy Efficient Appliance Standard includes a variety of new standards for lighting and for residential and commercial appliances and equipment. The following list contains some specific actions that can be taken to implement Energy Efficient Appliance Standard:
    - Distribute compact fluorescent bulbs, lighting occupancy sensors, and other energy saving devices;
    - Encourage the use of photovoltaic and other renewable energy applications;
    - Facilitate cooperative or aggregate purchase or buyer program for lighting, and energy efficient equipment;
    - Require the sale of only LCD computer monitors within city limits;
    - Create energy efficient office equipment procurement standards;
    - Distribute water saving devices such as low flow showerheads and faucet aerators.

Through the energy efficient equipment and lighting program, a minimum of 15 percent of electricity could be offset, which could prevent 23,331 metric tons of CO<sub>2</sub>e emissions.<sup>4</sup>

- Green power purchase (CR-3)  
A very small percentage of electricity currently provided to the Flagstaff Community is generated from renewable sources. The City of Flagstaff can encourage residents to purchase electricity generated from renewable sources (such as solar, wind, and hydroelectric), through various education programs. Through a combination of enthusiastic supporters buying 100 percent green power most residents along with businesses making a small adjustment to their energy bill, a 15 percent green power goal is well achievable. If a minimum goal of 10 percent of residential power is

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<sup>3</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different

<sup>4</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

obtained from renewable energy sources, a reduction of 15,554 metric tons of CO<sub>2</sub>e could be realized.<sup>5</sup>

- North Arizona University (NAU) projects (CR-4)  
Support NAU's GHG reduction strategies. Through its electricity and natural gas reduction projects, NAU could achieve 7,398 metric tons of CO<sub>2</sub>e emission reductions. The reduction projects and the projected CO<sub>2</sub>e reductions for each project are listed below:
- Carbon tax on fossil fuels and electricity (CR-5)  
Charging a carbon tax based on the amount of fossil fuels and electricity usage could reduce residential energy consumption. In addition, any financial returns from the carbon tax could be used as the funding mechanism for other GHG reduction projects (such as rebates for energy efficient retrofits, and distribution of energy efficient appliances). The CO<sub>2</sub>e emissions reduction from this measure is significantly dependent on various factors and is difficult to project. If 1 percent of natural gas and electricity can be saved, 2,589 metric tons of CO<sub>2</sub>e could be prevented. If 5 percent can be saved, 12,943 metric tons of CO<sub>2</sub>e could be prevented.<sup>6</sup> It is to be noted that the City of Boulder has developed and applied a carbon tax to its community that became effective in 2007. The City of Boulder carbon tax is expected to generate \$1 million annually.
- Other (CR-6)
  - Annual energy usage/cost data on real estate listings
  - Purchase of gas collected from landfill
  - Influence policy at other levels of government

With all the above mentioned measures, a total reduction of 82,502 metric tons of CO<sub>2</sub>e may be achieved by the year 2012, which is 31 percent of the current residential GHG emissions and 5 percent of the Flagstaff Community GHG emissions. Among these measures, energy efficient building, equipment and lighting and renewable electricity purchase are the biggest reduction measures. However, without mandatory changes to the building code, the entire reduction stated here will not be achieved.

## Commercial

More than 50 percent of electricity used in the City of Flagstaff is utilized by the commercial sector, and 30 to 50 percent of natural gas is utilized by commerce and industry. Reduction of energy usage by the commercial sector is important in reducing the Flagstaff Community GHG emissions. Similar GHG reduction measures to those of the residential sector also apply to the commercial sector due to the similarity of the energy usage profile for the two sectors. The following measures are recommended to reduce GHG emissions for the commercial sector.

- Green power purchase (CC-1)  
As discussed in previous sections, a very small percentage of electricity currently provided to the Flagstaff Community is generated from renewable sources. The City of Flagstaff can require commerce to purchase 10 percent

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<sup>5</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>6</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

renewable electricity by 2012.<sup>7</sup> This would prevent 35,827 metric tons of CO<sub>2</sub>e emissions.

- Energy efficient equipment and lighting, and energy conservation program (CC-2) The commercial sector consumes a significant amount of electricity which is used for lighting and cooling. The following actions are recommended:
  - Encourage the commercial sector to upgrade lighting systems to energy efficient technologies
  - Encourage the commercial sector to reduce the overall lighting wattage
  - Encourage the utilization of natural light
  - Require the sale of only LCD computer monitors within city limits
  - Require vending machine controllers (energy miser)
  - Create energy efficient office equipment procurement standards
  - Encourage installation of new commercial refrigeration equipment

It is projected that a minimum of 10 percent of electricity could be offset through the energy efficient equipment and lighting program.<sup>8</sup> This would achieve a GHG emissions reduction of 35,827 metric tons of CO<sub>2</sub>e.

- Energy efficient building construction (CC-3)  
The following reduction measures, similar to those of the residential sector, can be applied to commercial buildings:
  - Implement and enforce energy efficient building codes
  - Offer financial incentives (e.g., fee and tax reductions, rebates, and loans), to builders who construct energy efficient buildings
  - Require improvements in energy efficiency during remodeling/redevelopment projects
  - Encourage the use of energy efficient appliances and HVAC systems

In general, the rate of growth of commercial buildings is much lower than the rate of growth of residential buildings. Therefore, it is recommended that the City of Flagstaff encourage the commercial sector to retrofit existing buildings with energy efficient appliances and equipment through tax and fee reductions, and demonstrations of cost savings.

The historic natural gas consumption data provided by the City of Flagstaff does not separate usage values for the commercial and industrial sectors. If a combined reduction of 10 percent of natural gas used by the commercial and industrial sectors can be achieved through building retrofits and other actions, a total reduction of 5,226 metric tons of CO<sub>2</sub>e can be achieved.<sup>9</sup>

- Carbon tax on fossil fuels and electricity usage (CC-4)

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<sup>7</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>8</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>9</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

With all the above mentioned measures, a total reduction of 76,879 metric tons of CO<sub>2</sub>e may be achieved by the year 2012, which is 19 percent of current commercial GHG emissions and 5 percent of the total Flagstaff Community emissions. Similar to the residential sector, energy efficient buildings, equipment and lighting and renewable electricity purchases are the most effective reduction measures.

## Industrial

Approximately 20 percent of electricity used in the City of Flagstaff is utilized by industry, and 30 to 50 percent of natural gas is utilized by commerce and industry. To reduce the GHG emissions from the industrial sector, the following measures may be considered:

- Green power purchase (CI-1)  
Similar to the residential and commercial sectors, it is suggested that the City of Flagstaff require the industrial sector to purchase 10 percent of renewable electricity by 2012.<sup>10</sup> This would prevent 12,658 metric tons of CO<sub>2</sub>e emissions.
- Energy efficient equipment and lighting (CI-2)
  - Implement similar measures to the commercial sector
  - Upgrade motors and other electric facilities to more energy efficient equipment.
  - Install new more energy efficient boilers, furnaces, heaters, etc.It is projected that a minimum of 10 percent of electricity could be offset through the use of energy efficient equipment and lighting.<sup>11</sup> This would generate a reduction of 12,658 metric tons of CO<sub>2</sub>e.
- Energy efficient building construction (CI-3)
- Carbon tax on fossil fuels and electricity usage (CI-4)

## Transportation

The transportation sector contributes to approximately 50 percent of the total GHG emissions in the Flagstaff Community. The following policies/programs are recommended to reduce GHG emissions from community transportation.

- Renewable Fuels Standard (RFS) and alternative fuel program (CT-1)  
As discussed in the government measures section, 12 percent of renewable fuel could be used in the year 2012.<sup>12</sup> This would prevent 97,881 metric tons of CO<sub>2</sub>e emissions in 2012.
- Increase the number of hybrid cars (CT-2)  
Assuming that hybrid cars improve fuel economy by 40 percent, if 20 percent of cars can be replaced with hybrids by 2012, 8 percent of fuel usage could be saved, which could prevent 65,254 metric tons of CO<sub>2</sub>e emissions.<sup>13</sup>

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<sup>10</sup> The 10 percent reduction is deemed reasonable based on good engineering estimates and assumptions. The City of Flagstaff can revise this value based on the City of Flagstaff policy and requirements, and therefore the final value may vary.

<sup>11</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>12</sup> Based on the assumption that the RFS requirement will increase by 1% each year.

<sup>13</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

- **Corporate Average Fuel Economy (CAFE) Standard (CT-3)**  
Using a similar calculation method as discussed for the government measures, it is projected that the federal CAFE standard could save 20 percent of fuel usage by 2012. If 20 percent of cars are replaced with new cars by 2012, 4 percent of total fuel usage would be offset, which is equivalent to a reduction of 32,627 metric tons of CO<sub>2</sub>e.<sup>14</sup>
- **Community Trip Reduction Program (CT-4)**  
It is recommended that a community trip reduction program be developed to reduce the annual vehicle miles traveled by at least 5 percent<sup>15</sup>. Such a reduction would result in a GHG reduction of 27,326 tons of CO<sub>2</sub>e. The following are some specific recommendations to reduce community trips:
  - Implement policies that shift funds from roads and highways to alternative transit;
  - Reduce fares on public transit;
  - Engage community stakeholders to build their support for alternative transit;
  - Offer shuttle service that connects neighborhoods to commuter lines;
  - Offer shuttle service to nearby parks for tourists;
  - Encourage use of bike lanes, walking, light rail, and street cars; and
  - Create an alternative working schedule program for non-motorized commuters (e.g., flextime, compressed work week, and work from home).
- **State Clean Car Program (CT-5)**  
State Clean Car standards will take effect for model year 2011 (calendar year 2010) vehicles. It is estimated that a 1 percent reduction of CO<sub>2</sub>e emissions (8,157 metric tons) could be achieved by the year 2012, and a 9 percent reduction (73,411 metric tons) by the year 2020.<sup>16</sup>
- **Increase fuel efficiency (CT-6)**  
Develop driver training program “Smart Drive” for fuel efficiency; rewarding drivers of fuel efficient vehicles (e.g., through priority parking).
- **Carbon tax on gasoline and diesel usage (CT-7)**  
With all of the above mentioned measures, a total reduction of 231,245 metric tons of CO<sub>2</sub>e may be achieved by the year 2012, which is 28 percent of the current transportation GHG emissions and 14 percent of the total Flagstaff Community GHG emissions. Among these measures, the renewable fuel standard, hybrid cars, the fuel economy standard, and a community trip reduction program are the important and significant GHG reduction measures.

## Waste

Two basic strategies exist to reduce GHG emissions associated with solid waste: use less, and recycle more.

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<sup>14</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>15</sup> Based on good engineering estimates and assumptions.

<sup>16</sup> Based on the Arizona Climate Change Action Plan.

- Recycling (CW-1)  
The recycling strategy reduces overall GHG emissions compared to land filling since producing products from recycled materials generally requires substantially less processing and energy. The following are some example programs that can assist with recycling:
  - Conduct home composting education programs;
  - Establish a center for reusing salvageable goods;
  - Distribute compost bins;
  - Implement or expand residential and commercial recycling collection;
  - Establish community recycling drop-off sites;
  - Offer incentives to reduce waste such as “pay as you throw” or unit pricing, special taxes and tipping fees.

If 30 percent of paper product and 20 percent of food waste can be recycled, approximately 25,941 metric tons of CO<sub>2</sub>e emissions could be reduced.<sup>17</sup>

- Implement a landfill methane collection and conversion program (CW-2)  
Methane is emitted from the Cinder Lake Landfill due to the decomposition of waste inside the landfill. These methane releases are currently not collected. If 20 percent of methane can be collected by the year 2012, 14,082 metric tons of CO<sub>2</sub>e emissions would be prevented.<sup>18</sup> The collected methane can be converted to electrical energy and used to offset overall electricity consumption by the City of Flagstaff. Alternatively the collected methane can be used for heating.
- Use less - adopt resource conservation and waste prevention measures (CW-3)  
This strategy avoids the GHG emissions associated with the manufacturing process, and it also reduces the cost of purchasing supplies. If a minimum of 5 percent waste could be avoided, 4,261 metric tons of CO<sub>2</sub>e emissions could be reduced.<sup>19</sup>
- Use the methane extracted from the Cinder Lake Landfill to generate electricity or for heating (CW-4)
- Purchasing of recycled products (CW-5)
- Collecting trash tax (CW-6)

With all the above mentioned measures, a total reduction of 48,977 metric tons of CO<sub>2</sub>e may be achieved by the year 2012, which is 57 percent of the current waste sector emissions and 3 percent of the total Flagstaff Community GHG emissions. Among these measures, recycling and landfill methane collection are the most important reduction measures.

## Other

- Promote the use of low "global warming potential" refrigerants (CO-1)

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<sup>17</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>18</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

<sup>19</sup> The reduction is an assumption to demonstrate the impact of this emission reduction strategy. The final achievable reduction percentage may be different.

Among currently used refrigerants, approximately 50 percent is HFC-134a. If 10 percent of HFC-134a could be replaced with low GWP HFC refrigerants, 1,840 metric tons of CO<sub>2</sub>e emissions could be reduced from air conditioning system. R-22, which is not a HFC, may also be used as a replacement.

- Tree planting program (CO-2)  
Trees act as sinks for CO<sub>2</sub> as well as providing shade that can keep pavement cool in the summer. The City of Flagstaff can consider planting additional trees along roads, houses, and in open land.

## Summary

In the current Flagstaff Community GHG emissions profile, transportation is the highest Emitting sector (50 percent), followed by the commercial (25 percent), and residential (15 percent) sectors. These three sectors contribute approximately 90 percent of total Flagstaff Community GHG emissions. Therefore, the implementation of reduction measures on transportation fuel consumption and energy consumption by the commercial and residential sectors is of primary importance to reduce the overall GHG emissions in the City of Flagstaff.

With all of the proposed Flagstaff Community measures, it is projected that a total reduction of 466,758 metric tons of CO<sub>2</sub>e could be achieved by 2012. Without any mitigation strategies, the 2012 Flagstaff Community emission levels are projected to increase to 1,695,492 metric tons of CO<sub>2</sub>e, which is **52 percent above** 1990 levels. However, with all of the proposed measures, the projected 2012 community emission levels are still **10 percent above** 1990 community levels.

Reaching the 7 percent reduction goal would take an additional reduction of 190,168 metric tons of CO<sub>2</sub>e, which is equivalent to a 23 percent reduction in transportation emissions, or a 28 percent reduction in residential and commercial energy consumption, or some combination of the two. This must be based on the more aggressive implementation of more stringent standards or policies, especially in the transportation sector. These policies may include:

- Higher Renewable Fuels Standard, such as 30 percent, instead of the projected 12 percent by 2012.
- Increase the number of hybrid cars by a higher percentage, such as 50 percent, rather than the currently projected 20 percent.
- Develop extensive public transportation to replace current individual transportation.
- Mandate energy efficiency on all new and remodeled residential and commercial buildings.
- Require residential, commercial and industrial customers to purchase more green power, such as 30 percent instead of the currently projected 10 percent.

Table 1-1 shows the amount of GHG emissions reductions achievable under each individual policy option in 2012:

**TABLE 1-1 PROPOSED FLAGSTAFF COMMUNITY GHG REDUCTION**

<b>Measure Code</b>	<b>Measure Description</b>	<b>CO2e Reduction (metric ton)</b>
CT-1	Renewable Fuels Standard (RFS) and alternative fuel program	97,881
CT-2	Increase number of hybrid cars	65,254
CR-1	Energy efficient building in residential	36,219
CC-1	Green power purchase in commercial	35,827
CC-2	Energy efficient equipment and lighting, and energy conservation program in commercial	35,827
CT-3	Corporate Average Fuel Economy (CAFÉ) Standard	32,627
CT-4	Community Trip Reduction Program	27,326
CW-1	Recycling	25,941
CR-2	Energy efficient equipment and lighting in residential	23,331
CW-2	Implement a landfill methane collection and conversion program	18,776
CR-3	Green power purchase in residential	15,554
CI-1	Green power purchase in industrial	12,658
CI-2	Energy efficient equipment and lighting in industrial	12,658
CT-5	AZ State Clean Car Program	8,157
CR-4	North Arizona University projects	7,398
CC-3	Energy efficient building in commercial	5,226
CW-3	Use less to generate less waste	4,261
CO-1	Promote the use of low "global warming potential" refrigerants	1,840
CC-4	Carbon tax on natural gas and electricity in commercial	-
CI-3	Energy efficient building in industrial	-
CI-4	Carbon tax on natural gas and electricity in industrial	-
CO-2	Tree planting program	-
CR-5	Carbon tax on fossil fuels and electricity in residential	-
CR-6	Other residential measures	-
CT-6	Increase fuel efficiency	-
CT-7	Carbon tax on gasoline and diesel	-
CW-4	Use the methane coming from landfills to generate electricity	-
CW-5	Purchasing of recycled products	-
CW-6	Trash tax	-

**PLEASE SUBMIT YOUR COMMENTS ON THE PROPOSED COMMUNITY MITIGATION STRATEGIES TO:**

**E-mail:** [nwoodman@ci.flagstaff.az.us](mailto:nwoodman@ci.flagstaff.az.us). Attention: GHG Inventory.

**Phone:** 928-213-3608 Fax: 928-779-7696

**Mail:** City of Flagstaff, Sustainability Program, 211 West Aspen Ave., Flagstaff, Arizona 86001

Additional information on the greenhouse gas inventory can be found at [www.ci.flagstaff.gov](http://www.ci.flagstaff.gov).